

CLAIMS

What is claimed is:

1. A method of cleaning a semiconductor wafer including at least one registration mark, comprising:
providing a semiconductor wafer comprising at least one registration mark, the at least one registration mark comprising at least one trench having a trench width from approximately 1.0 μm to approximately 3.0 μm ;
exposing the semiconductor wafer to a cleaning solution comprising tetramethylammonium hydroxide and at least one surfactant, the at least one surfactant comprising at least one acetylenic diol surfactant; and
exposing the semiconductor wafer to ultrasonic or megasonic vibrational energy.
2. The method of claim 1, wherein providing a semiconductor wafer comprising at least one registration mark comprises providing a semiconductor wafer contaminated with organic particles in the at least one registration mark.
3. The method of claim 1, wherein providing a semiconductor wafer comprising at least one registration mark comprises providing a semiconductor wafer contaminated with polymeric, organic particles in the at least one registration mark
4. The method of claim 1, wherein providing a semiconductor wafer comprising at least one registration mark comprises providing a semiconductor wafer having at least one registration mark having trenches at least partially filled with organic particles.
5. The method of claim 1, wherein providing a semiconductor wafer comprising at least one registration mark comprises providing a semiconductor wafer comprising at least one registration mark having a trench width of approximately 1.2 μm .

6. The method of claim 1, wherein providing a semiconductor wafer comprising at least one registration mark comprises providing a semiconductor wafer comprising at least one registration mark having a trench width of approximately 2.8 μm .

7. The method of claim 1, wherein exposing the semiconductor wafer to a cleaning solution comprising tetramethylammonium hydroxide and at least one surfactant comprises exposing the semiconductor wafer to a cleaning solution comprising from approximately 0.01% by weight to approximately 25% by weight tetramethylammonium hydroxide.

8. The method of claim 1, wherein exposing the semiconductor wafer to a cleaning solution comprising tetramethylammonium hydroxide and at least one surfactant comprises exposing the semiconductor wafer to a cleaning solution having a pH greater than approximately 7.5.

9. The method of claim 1, wherein exposing the semiconductor wafer to a cleaning solution comprising tetramethylammonium hydroxide and at least one surfactant comprises exposing the semiconductor wafer to a cleaning solution having a pH greater than approximately 9.

10. The method of claim 1, wherein exposing the semiconductor wafer to a cleaning solution comprising tetramethylammonium hydroxide and at least one surfactant comprises exposing the semiconductor wafer to a cleaning solution having a pH greater than approximately 10.

11. The method of claim 1, wherein exposing the semiconductor wafer to a cleaning solution comprising tetramethylammonium hydroxide and at least one surfactant comprises exposing the semiconductor wafer to a cleaning solution comprising tetramethylammonium hydroxide and Surfynol® CT-131.

12. The method of claim 1, wherein exposing the semiconductor wafer to a cleaning solution comprising tetramethylammonium hydroxide and at least one surfactant comprises exposing the semiconductor wafer to a cleaning solution comprising tetramethylammonium hydroxide and at least one surfactant comprising from approximately 20% to approximately 50% α -(nonylphenyl)-omega-hydroxy-branched poly (oxy-1,2-ethanediyl) and from approximately 2% to approximately 10% 2,4,7,9-tetramethyl-5-decyne-4,7-diol-ethoxylate.

13. The method of claim 1, wherein exposing the semiconductor wafer to a cleaning solution comprising tetramethylammonium hydroxide and at least one surfactant comprises immersing the semiconductor wafer in the cleaning solution.

14. The method of claim 1, wherein exposing the semiconductor wafer to ultrasonic or megasonic vibrational energy comprises exposing the semiconductor wafer to a vibrational energy ranging from approximately 40 kHz to approximately 104 kHz.

15. The method of claim 1, wherein exposing the semiconductor wafer to ultrasonic or megasonic vibrational energy comprises exposing the semiconductor wafer to a vibrational energy ranging from approximately 850 kHz to approximately 1.5 MHz.

16. The method of claim 1, further comprising exposing the semiconductor wafer to a temperature ranging from approximately 25°C to approximately 65°C.

17. The method of claim 1, further comprising exposing the semiconductor wafer to a temperature ranging from approximately 55°C to approximately 65°C.

18. The method of claim 1, wherein exposing the semiconductor wafer to a cleaning solution comprising tetramethylammonium hydroxide and at least one surfactant comprises spraying the cleaning solution on a surface of the semiconductor wafer.

19. A method of cleaning a semiconductor wafer including at least one registration mark, comprising:

providing a semiconductor wafer comprising at least one registration mark, the at least one registration mark comprising at least one trench having a trench width from approximately 1.0 μm to approximately 3.0 μm ;

contacting the semiconductor wafer with a spray of a cleaning solution comprising tetramethylammonium hydroxide and at least one surfactant, the at least one surfactant comprising at least one acetylenic diol surfactant.

20. The method of claim 19, wherein providing a semiconductor wafer comprising at least one registration mark comprises providing a semiconductor wafer having organic particles in the at least one registration mark.

21. The method of claim 19, wherein providing a semiconductor wafer comprising at least one registration mark comprises providing a semiconductor wafer having polymeric, organic particles in the at least one registration mark.

22. The method of claim 19, wherein providing a semiconductor wafer comprising at least one registration mark comprises providing a semiconductor wafer having at least one registration mark that is at least partially filled with the organic particles.

23. The method of claim 19, wherein providing a semiconductor wafer comprising at least one registration mark comprises providing a semiconductor wafer comprising at least one registration mark having a trench width of approximately 1.2 μm .

24. The method of claim 19, wherein providing a semiconductor wafer comprising at least one registration mark comprises providing a semiconductor wafer comprising at least one registration mark having a trench width of approximately 2.8 μm .

25. The method of claim 19, wherein contacting the semiconductor wafer with a spray of a cleaning solution comprising tetramethylammonium hydroxide and at least one surfactant comprises contacting the semiconductor wafer with a high-pressure jet spray or a high-velocity aerosol spray.
26. The method of claim 19, further comprising exposing the semiconductor wafer to an ultrasonic or megasonic vibrational energy.
27. A semiconductor wafer previously subjected to an abrasive planarization treatment and having a reduced amount of organic particles in at least one registration mark thereon, wherein the at least one registration mark comprises at least one trench comprising less than approximately 13% of its surface area filled with the organic particles.
28. The semiconductor wafer of claim 27, wherein the at least one registration mark comprises at least one trench comprising less than approximately 10% of its surface area filled with the organic particles.
29. The semiconductor wafer of claim 27, wherein the at least one registration mark comprises at least one trench comprising less than approximately 5% of its surface area filled with the organic particles.